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Cutting edge micro satellite achieves milestones

Space Vehicles Directorate's Experimental Satellite System-11 performs several rendezvous and proximity operations with launch vehicle upper stage

A 220-pound micro satellite developed by the Air Force Research Laboratory, Space Vehicles Directorate, Kirtland Air Force Base, N.M., recently accomplished significant mission milestones by rendezvousing three to four times with the upper stage of the Minotaur I launch vehicle at distances between 1.5 kilometers and 500 meters.

The Air Force has employed the Experimental Satellite System-11, commonly referred to as XSS-11, to investigate a variety of prospective space applications including servicing, repair, and re-supply.

"XSS-11 is demonstration in space rendezvous and proximity operations," said Harold "Vernon" Baker, XSS-11 program manager. "The spacecraft also has an on-board rendezvous and proximity operations planner in the avionics to aid in developing autonomous operations for future concepts and missions."

Launched in April 2005 from Vandenberg Air Force Base, Calif., XSS-11 has also completed more than 75 natural motion circumnavigations of the expended rocket body. During its projected 12 to 18-month flight, the spacecraft will conduct rendezvous and proximity maneuvers with several U.S.-owned dead or inactive resident space objects near its orbit, as well as will demonstrate more autonomy as the project continues.

"The micro satellite is performing better than expected," Baker said. "Fuel consumption and efficiency is good, and we expect to be operational for another year. In addition, we have had no significant technical glitches and no major anomalies."

Managing and monitoring the micro satellite's progress has been the focus of the flight control team comprised of personnel from both the Space Vehicles Directorate, as well as the Space and Missile Systems Center's Detachment 12, also located at Kirtland AFB. Staffing, however, has been reduced from 30 to 15 due to the spacecraft's flawless performance, and another decrease is expected in the future as the micro satellite's demonstration in autonomy advances.

With a projected cost of \$82 million, the XSS-11 program has planned an aggressive, event driven flight, which could ultimately enhance the Air Force Space Command's possible prospective mission of space servicing and maintenance, as well as space support and efficient operations. In addition, due to its innovative autonomous flight, the XSS-11 mission may reduce the number of personnel and the amount of equipment needed to operate future space missions.

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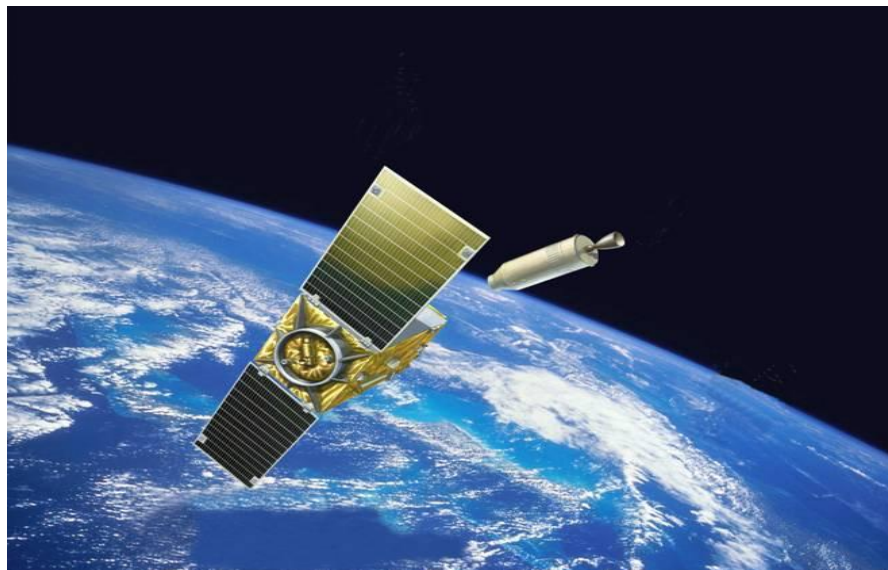
“The micro satellite will remain in a systems functional test for the next month or two, as we are still checking out the spacecraft’s various components,” the XSS-11 program manager said. “The whole part of this mission is to be safe. If we hit the resident space object, we fail.”

Because of the XSS-11’s groundbreaking flight, several national media organizations, including *Popular Mechanics*, MSNBC.com, and Space.com have published articles about the micro satellite. Likewise, the December 2005 issue of *Popular Science* will also feature a story on the spacecraft’s unique mission.

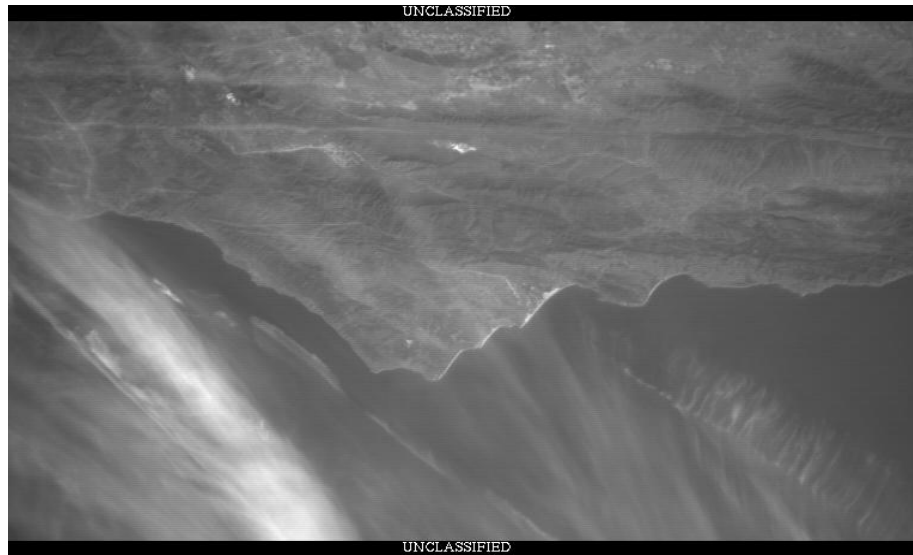
“To date, most other rendezvous experiments have been designed primarily for the purpose of docking and repair missions. They relied heavily on the other object having guidance and navigation aids, as well as docking mechanisms,” Baker said. “XSS-11 does not rely on navigation aids from the other resident space objects or docking mechanisms.”

The XSS-11 project represents a partnership between DOD and industry. For example, Jackson and Tull, Albuquerque, NM, provided technical support to the program office in design, build, integration, test, and launch activities as well as continued support for ongoing mission operations. Lockheed Martin Astronautics, Waterton, Colo., served as the spacecraft’s contractor for structure, propulsion, and system support. In addition, other private sector companies participating in the program included Broad Reach Engineering, Tempe, Ariz.; Octant Technologies, San Jose, Calif.; Draper Laboratory, Cambridge, Mass.; and SAIC, San Diego, Calif. Another key XSS-11 player has been the Air Force’s Space Test Program administered by SMC, Det. 12, which has provided launch, as well as on-orbit command and control oversight.

In the coming weeks and months, the micro satellite will continue its rendezvous and proximity mission, but the next event date and participating resident space object will be determined at a later date based on schedule and which U.S.-owned dead or inactive object best meets the mission requirements. Nevertheless, the XSS-11’s accomplishments in its initial months of flight have laid the groundwork for future success.



Artist Rendition of XSS-11 imaging expended upper stage of launch vehicle



Photograph of the southern California coastline taken by the XSS-11's witness camera. Vandenberg Air Force Base, site of the micro satellite's launch on April 11, 2005, is a white speck photographed on the hump in the middle of the Picture (Photo courtesy of Harold "Vernon" Baker)



Photograph of the upper stage of the Minotaur I launch vehicle taken from the XSS-11 spacecraft at a distance of 0.5 kilometers. (Photo courtesy of Harold "Vernon" Baker)